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ABSTRACT

Concepts of critical thinking and psychological type are reviewed. An instrument that has gained wide acceptance for evaluating individual preferences is the Myers-Briggs Type Indicator (MBTI). Four dimensions of the MBTI that can also be considered learning preferences, with their associated contrasting preferences, are: (1) orientation toward information and idea generation (extraversion and introversion); (2) perception of information or ideas (sensing or intuition); (3) judgment or decision making (thinking and feeling); and (4) orientation to environment (judgment and perception). Combinations result in 16 type possibilities. Research has established that specific preferences and characteristics are associated with these types. For example, "introvert-sensing-thinking-judgment" learners tend to be analytical, fact-minded, dependable, reflective, and practical. The key to developing a learner's ability to think critically is found in the order of the learner's preferences for perception and judgment. Teaching may be improved by emphasizing learners' dominant ways of perceiving and judging. Learners who know their own preferred and non-preferred approaches can reinforce their strengths while working to overcome their weaknesses. Two tables and two figures illustrate the text. (SLD)

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IMPROVING LEARNING BY COMBINING CRITICAL THINKING SKILLS WITH PSYCHOLOGICAL TYPE

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For years educators have struggled with theories and methods toward improving the learning process. We continue to search for reliable means to determine how learners learn and what the most effective ways are to meet those learning needs. Recently, Fredericksen noted that the task of education through all levels is to improve knowledge and to develop cognitive skills (10). Fredericksen suggested that, among the cognitive skills needing improvement, problem solving is one of the most important. We agree.

Problem solving, or skills in perception and judgment which lead to problem solving, are particularly important to the attainment of so called higher order thinking skills. These skills, or critical thinking skills as they are sometimes called, involve the ability to analyze, synthesize, and evaluate information. The quest to develop these skills among learners has become a number one priority of education (2).

THE CONCEPT OF CRITICAL THINKING

Campbell and Macey noted that a commonly accepted definition of critical thinking is elusive. They point out that critical thinking is not easily defined as it used synonymously with and engenders much of associated terms such as problem solving (as we have so far in this paper), analytical reasoning, creative thinking, and analysis. They contend critical thinking refers to:

> ". . . one's openness to maintain a close examination of problems and circumstances. . . necessary to evaluate the pros and cons of the issue or alternatives. It refers to a form of evaluation and judgment free of bias and interference." (7)

Robert Ennis, a leading authority on critical thinking, suggests one must have both the proper inclinations and the dispositions to think critically. Ennis suggests that there are specific areas of critical thinking that one can learn and/or strengthen (9). Just having the "right attitude" about using critical thinking to improve oneself intellectually will not suffice. Abilities to think critically must also be improved (8; 13; 16).

In terms of learning, critical thinking may be viewed as an internalized process that is active and persistent during which one carefully evaluates information in a systematic and objective manner. This view suggests that critical thinking is heuristic and cognitive. It is self-directed and internalized rather than a formalized problem solving process. Preferably, critical thinking is something one does in advance of taking action.

This definition has immense importance when the notions of cognitive preferences are addressed later in this paper.

RESEARCH PREMISE

The authors believe that learning might be enhanced if learners' individual preferences are diagnostically evaluated through an analysis of psychological type. Once individual learning preferences are identified, these preferences could be integrated with appropriate teaching methods to improve higher order thinking skills.

The task, then, includes identifying learners' preferred cognitive strategies, determining which learning approaches are preferred by those learners, and presenting learning opportunities designed to improve critical thinking skills. Improvement can be achieved by matching learners' preferences and stretching the learner toward developing the non-preferred cognitive strategies.

THE MYERS-BRIGGS TYPE INDICATOR (MBTI)

One instrument theory that has gained wide acceptance for evaluating individual preferences is the Myers-Briggs Type Indicator (MBTI). The MBTI is based upon the work of Swiss psychologists Garl Gustav Jung who discovered that one's psychological type determines and limits one's judgment and establishes one's relationship to the world (14). Leading researchers such as Myers (1962; 1979; 1980), Lawrence (1982;

1984), Keirsey and Bates (1978), and McCaulley (1976) have helped to establish a base of knowledge and application of type theory to educational settings.

The MBTI is currently one of the most popular diagnostic assessment instruments in the United States. It is adaptable to individuals or groups; can be computer or hand scored; it is untimed, non-threatening and non-pathological. The Indicator uses an easy to follow vocabulary; has an abundant research base; and has acceptable validity and reliability measures (5). As of this writing, more than 1100 dissertations, theses, books, and journal articles have been published on the MBTI. The utility of the instrument appears to be in the diverse interest areas of education, religious issues, psychological aspects, counseling, and management and organizational behavior.

MBTI theory is built upon four precise dimensions, each containing two distinct opposites with contrasting preferences. For the purposes of this paper, we refer to them as learning preferences and define them as ways and methods used to interact based upon experience and trust; they represent one's greatest learning strengths (20). The four dimensions of the Indicator are depicted in Figure 1.

The first dimension, orientation toward information and idea generation, is concerned with one's direction toward information and ideas. Dimensions two and three include how that information

is processed through the mental functions of perception and judgment. The fourth dimension measures how the processed information is dispersed into the environment. While all four dimensions are important to developing higher order thinking skills, dimensions two and three are very important to ascertain whether critical thinking skills have become incorporated into one's cognitive strategy to process information.

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FIGURE 1 MEASUREMENT AREAS OF THE MBTI

ORIENTATION TOWARD INFORMATION/IDEA GENERATION

EXTRAVERSION (E): Outer world of activity and action
INTROVERSION (I): Inner world of reflection and contemplation

PERCEPTION OF INFORMATION OR IDEAS

SENSING (S): Observable facts and details
INTUITION (N): Insight of meanings and relationships

JUDGMENT OR DECISION MAKING

THINKING (T): Conclusions via logic, analysis and objective reasoning
FEELING (F): Decisions based on subjectivity, human values, and what is personally important

ORIENTATION TO ENVIRONMENT

JUDGMENT (J): Desire for organization, plans, control and closure
PERCEPTION (P): Curious, openness, receptive, flexible and adaptive

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Each dimension of the four measurement scales contains distinct and polar opposites of contrasting preferences. While learners possess all of the qualities inherent with each dimension, one particular set or combination becomes most

preferred. The combinations result in sixteen type possibilities.

ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

Thus, the description for a person such as an ESTJ highlights their preference for generating information and ideas in the outer world of activity and actions (Extraversion), perceiving observable facts and details (Sensing), deciding or judging those perceptions through logic, analytical and objective reasoning (Thinking), and living in the outer world in an organized, planned, controlled fashion (Judgment) (5).

Type Theory and Learning

The fundamental idea of type concerns what seems as chance variation in human behavior occurs not by chance but by observable differences in mental functioning. These basic differences stem from the way learners prefer to use their minds; that is, how information is generated, perceived, judged, and used. Since the functions of perceiving and judging information account for the largest portion of one's mental activity and thus govern behavior, the authors believe a key to effective learning can be provided once these perceptions and judgments are known.

Research provides conclusive evidence that specific preferences and characteristics are associated with the MBTI

preferences. The discovery of different learning preferences reinforces the contention that a variety of learning opportunities -- both preferred and non-preferred -- are appropriate to meet the task of education. Figure 2 depicts the preferences associated with the eight dimensions of type theory.

Figure 2 Learning Preferences Associated with the MBTI

Extraversion	Introversion
Talking and Discussion	Reading/Verbal Reasoning
Psychomotor activity	Time for internal processing
Group activities	Individual work
Sensing	**Intuition**
Tasks calling for carefulness thoroughness and sound understanding	Tasks calling for quickness of insight and seeing relationships
Linear processing of routine	Global, finding new ways
Specifics	Concepts
Thinking	**Feeling**
Objective material	Personal relationships
Logical organization of teacher	Personal rapport with teacher
Rules, laws and procedures	Harmony, empathy and balance
Judgment	**Perception**
Structure and order	Flexible and adaptive
Formal instruction methods	Informal problem solving
Directed	Autonomous

Psychological Type and Learning Research

Teachers frequently comment that learners in one particular class or course seem different than those in other courses. They also express concern that some established teaching strategies are more or less appropriate for these differing groups. It seems natural that as learners are grouped, they also take on a

"personality" or distinguishing characteristics about their preferred learning approaches.

Over the past few years, several research efforts have used the MBTI to determine personality differences of learners attending the Air Force Institute of Technology, a graduate and professional education school of the Department of Defense. Table 1 shows the type frequency and percentage of those learners surveyed by Campbell (4;5;6). The Table reflects the differences in learning personality -- in particular the near 31% ISTJ and 58% ST distribution of learners. Table 2 provides typical learning characteristics suggested by Morgan in Lawrence (1982), Keirsey and Bates (1978), and Lawrence (1982) as associated with the most frequent learner type, the ISTJ.

TABLE 1 LEARNER TYPE DISTRIBUTION
(Frequency/Percentage)

N=1730

ISTJ 530/30.6%	ISFJ 110/6.4%	INFJ 15/0.9%	INTJ 140/8.1%
ISTP 124/7.2%	ISFP 45/2.6%	INFP 42/2.4%	INTP 99/5.7%
ESTP 58/3.4%	ESFP 16/0.9%	ENFP 26/1.5%	ENTP 61/3.5%
ESTJ 285/16.5%	ESFJ 43/2.5%	ENFJ 23/1.3%	ENTJ 113/6.5%

E:	625/36.1%	S:	1211/70%	T:	1410/81.5%	J:	1259/72.8%
I:	1105/63.9%	N:	519/30%	F:	320/18.5%	P:	471/27.2%

ST: 997/57.6% NF: 106/6.1%
SF: 214/12.4% NT: 413/23.9%

ISTJ learners, the most common type in this research, tend to be analytical, fact-minded, dependable, preserving, thorough, able to handle difficult and detailed figures, practical organizers, and managers of details and systems. These learners are reflective rather than active. In addition, they tend to be impulsive, prefer deadlines and closure. They seem more comfortable with lectures, labs, demonstrations, while showing less comfort with student-lead presentations.

TABLE 2

LEARNING CHARACTERISTICS ASSOCIATED WITH ISTJ LEARNERS

1. Works easily alone (I)
2. Likes Lectures (I)
3. Likes direct experiences (S)
4. Likes audiovisuals (S)
5. Prefers well-defined goals (S)
6. Prefers practical tests (S)
7. Needs to know why before doing (S)
8. Linear learner with strong need for order (SJ)
9. Wants logically-structured efficient materials (IT)

Source: "Relating Type to Instructional Strategies", Margaret Morgan as reported in People Types and Tiger Stripes, Gordon Lawrence, ed, Center for Applications of Psychological Type, Inc., Gainesville FL, 1982, p53.

Logically, specific learning opportunities conducive to ISTJ learning preferences seems appropriate. It is also logical to present other learning situations calling for the ISTJ (and other types) to use and develop less-preferred learning approaches. One real world problem learners must address is that life does not always present itself in one's favored way. Thus, presenting problems that may be best solved through non-preferred approaches enhances critical thinking skill and ability.

RELATING THE MBTI TO CRITICAL THINKING

Until now this paper has addressed the task of education as improving knowledge and developing learners' ability to think. We have suggested that a way of meeting this task can be found in the concepts of critical thinking and psychological type. We have demonstrated that research attributes certain learning characteristics to specific psychological types. We now turn to the central issue of identifying which specific approaches might be developed. In isolating these approaches, we suggest they are different due to differences of psychological type. We argue that knowing learners' preferences for certain cognitive strategies permits development of more reliable approaches for improving learning, thinking, and knowledge.

The Key to Thinking Critically -- The Cognitive Functions

Cognition is referred to as the action of intellect -- the ability to learn and reason; a capacity for knowledge and understanding (1). It is comprised of a number of distinct aspects such as accrual of stimuli, sorting, memory, language, thinking, reasoning, and numerous other discrete mental functions (19). For our purposes, we have separated these functions into two categories termed perception and judgment. Further, we have applied the Type Indicator measurements of these categories to emphasize more precise categories of Sensing and iNtuitive perception and Thinking and Feeling judgments.

Order of Cognitive Preference

The key to developing a learner's ability to think critically is found in the order of the learner's preferences for perception and judgment. That is, learners develop (or prefer) the four possibilities of perception and judgment in some rank order. Learners use all mental processes identified by the Indicator - S, N, T, and F. However, type theory holds that a particular set or order of development occurs with each of the sixteen types. Further, the development of one dimension causes the opposite in the dichotomous pair to become less developed or non-preferred. For example, as a learner develops a preference for Sensing perception, the preference for iNtuitive perception becomes less preferred. Likewise for judgment -- Thinking and Feeling. The key to developing a learner's ability to think critically is held by the order of the learner's preference for Sensing, iNtuition, Thinking, and Feeling.

The function developed in the first order of preference is termed dominant. The second is called auxiliary; the third tertiary; and the fourth is called inferior or least preferred. For our purposes, we will discuss only the relevance of the dominant and inferior functions.

The matter of development is further ordered by one's preference for Extraversion and Introversion. That is, the preferred way of generating information and ideas (the E-I scale measurement) determines the direction that the order is directed.

For Extraverts, the dominant function is extraverted. They are more likely noticed as active, outgoing engagers of the environment. On the other hand, for Introverts the dominant function is introverted. Their dominant function would be directed inward through a world of contemplation and thought. The dominant functions for the sixteen types are highlighted as Extraverted or Introverted in the following type table.

ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

For example, IS learners have developed their Sensing preferences in an Introverted fashion. As Introverts, their inner world of thoughts and ideas would direct their dominant function. They would be seen to engage their mental processes in quiet, reflective, pondering ways. As Sensors, they prefer to perceive facts, details, things as they are or should be, in sequence, experientially based, and in pragmatic terms. It is reasonable to expect IS learners to be uncomfortable in circumstances calling for iNtuitive perception. In fact, they might be expected to avoid dealing in abstract, complex ambiguous issues, and with concepts and ideas involving the big picture. Rather, they would find attraction in known facts and issues, sort things into definable terms, and determine concrete applications in step-by-step, manageable portions. All of this occurring internally as their mind processes the data, and influenced by their dominant function.

Learning Opportunities for Cognitive Development

It is clear that certain dominant types prefer to perceive and judge in ways different than others. It should also be clear that teaching may be improved by emphasizing learners' dominant ways of perceiving and judging. Employing teaching strategies that appeal more to the inferior or least preferred function -- unless consciously done to specifically develop the inferior function -- increases the chance for ineffective learning.

So, what kinds of strategies would we offer to teach higher order thinking skills to a group of learners who are, as in the research sample, predominantly typed as ISTJ?

ISTJs possess what Ennis calls a "disposition" for learning critical thinking skills and the "elementary clarification" abilities of critical thinking (9). They have reasonable abilities at focusing on questions and analyzing arguments. However, they need practice in withholding their judgment to better assess the credibility of sources. Because their iNtuition is less developed, they would benefit from practice in projecting their perception into the complex, ambiguous portions of thinking.

As Introverts, they will need work on interacting with others through the use of techniques such as brainstorming and group processes. As dominant Sensors, they can improve their critical thinking skills by practicing dialogical thinking, as in

deductive exercises. As Thinkers, they should seek out and consider others' personal values and feelings while suspending their own. Because they are also Judgers, they tend to prefer clearly organized, somewhat rigid plans and work. The tendency toward deadlines and closure might lead to impulsiveness.

The major focus at improving their critical thinking skills should be directed at strengthening their Sensing perception while developing their iNtuition perception. This calls for seeking new ideas and thoughts while withholding judgment. According to Campbell (1986b), success may be achieved through a battery of approaches such as: one-on-one and individual projects and activities; presenting facts in a sequential manner; seeking answers to "why?" and "what if?" questions; generating and manipulating a variety of ideas and concepts; relating experiences to learner senses; use of logic and analytical reasoning; investigating the meaning of data and searching beyond the facts for implications; relating to objective data; and requiring structure in learning situations.

IMPLICATIONS AND CONCLUSIONS

This paper reviewed the concepts of critical thinking and psychological type. The theme suggests that the key to empowering learners to think critically is found in their preferred ways of perceiving and judging. The argument is that developing learning opportunities to meet and stretch learning preferences can best meet the task of education. This paper is

concluded by noting three implications when the concepts of critical thinking and psychological type are combined.

Implications for Learners

Learners address education with a wide variety of reasons and purposes. These reasons and purposes center around seeking greater knowledge, improved skills, or self-improvement. The concept of psychological type establishes each learner's similar and unique preferences for learning approaches. The identification makes learners aware of strengths and weaknesses, and helps chart a path toward developing new approaches. Learners knowing their preferred and non-preferred approaches to learning have the advantages of reinforcing their strengths, while working to overcome their weaknesses.

Skills in thinking critically can be improved when the dynamics of learners' dominant and inferior functions are incorporated in learning opportunities. Matching learning objectives to learner cognitive skills and abilities seems more likely to be effective. Matches and mis-matches signal the need for special approaches and possible outcomes. Learners are more likely to understand and seek those learning situations they identify with or in which they feel most comfortable.

Implications for Teachers

It is the nature of our profession to improve learners' knowledge and to strengthen their approaches toward learning. As educators, we strive to teach higher order thinking skills and strengthen learners' underdeveloped skills. Knowing learner preferences offers an advantage of structuring those methods, techniques and devices most likely to result in increased learning, while focusing on non-preferred areas to improve the ability to learn in less preferred approaches.

We do not suggest carte blanche adoption of those techniques and methods desired by the learning majority. Clearly, all types are not present or evenly distributed in our classrooms. It does however, seem reasonable that we do and should follow patterns of learner preference. There seems to be some value in teaching to the masses -- the modal type -- yet offering others a menu of learning opportunities structured for them. Offering a menu improves chances of appealing to preferences of under represented learner types. It also presents challenges for the modal type learners. The challenges offer these learners opportunities to stretch and develop other learning approaches -- their inferior preferences.

Keying on learners' cognitive preferences leaves the task of teaching learners to think critically less to chance. If a learner's dominant strength lies in Sensing perception and the learning objective involves developing iNtuitive perception, then

those strategies that must be developed to meet the learning objectives become clear. Without the key, learning effectiveness may not be achieved.

Being aware of learners' personality types helps identify those teaching/learning strategies best suited to develop higher order thinking skills. The authors believe that matching individual learning preferences with selected teaching strategies should offer improved learning. Learning may be improved still more when learners' dominant cognitive functions are addressed.

Impacts on Learning Systems

In addition to packaging and offering learning opportunities, the notion of psychological type raises several important concerns about how learning is evaluated and administered. Our suggestions also call for a wider range of educational reform. The issue of tests measuring not knowledge or learning but skill in test taking takes on new dimensions when cognitive skills are considered. If tests are developed for different learner psychological type, would the measurements be more accurate? Or, as some would argue, are tests in themselves a learning experience and should they therefore be used to match some learners and to stretch others?

And what about how learners are administered? Orientations, dormitories, study carrels, guidance and counseling services,

student activities, the design and availability of campus facilities, etc., may have tremendous impact on learners' openness to learn stemming from psychological type. Incorporating type theory into administration seems necessary to support the quest for knowledge and thinking skills.

Learners are great complainers. They are quick to express feelings such as being lost, stupid, or too thick to learn. Subjects are too tough; teachers are bad and can not teach. With feelings as those it is no wonder the teachable moment is suppressed. Greater appeal to type and cognitive preferences may not only cause those moments to increase, but also enable learning to flourish.

REFERENCES

(1) American Heritage Dictionary. Second College Edition, Houghton Mifflin Company: Boston. 1982, p668.

(2) Baron, Joan and Sternberg, Robert, eds. Teaching Thinking Skills: Theory and Practice. New York: W. H. Freeman and Company, 1987.

(3) Bloom, Benjamin S. et.al., ed. Taxonomy of Educational Objectives Handbook I: Cognitive Domain. New York: David McKay Company, Inc., 1956.

(4) Campbell, Dennis E. "An Analysis of Adult Learning Styles Using the Myers-Briggs Type Indicator." Lifelong Learning Research Conference Proceedings, University of Maryland, MD, February 21-22, 1985. pp 125-129.

(5) _____ Adult Learners' Changes and Adaptations of Learning Methods, Techniques and Devices by Psychological Type. University Microfilms Inc., Ann Arbor Michigan. 1986.

(6) _____ "Helping Learners Learn: A Study of Learning Preferences, Teaching Styles, and Learning

Systems." 1986 Air Force Conference on Technology in Training and Education Proceedings. Montgomery AL, March] 10-13 1986. pp II 30-45.

(7) Campbell, Dennis E. and Macey, James R. "Critical Thinking: Its Relationship in Education and Training." Proceedings 1988 Conference on Technology in Training and Education, Biloxi MS, Mar 1988, pp 634-649.

(8) De Bono, Edward. Lateral Thinking. New York: Harper and Row, Publishers, 1970.

(9) Ennis, Robert H. "A Taxonomy of Critical Thinking Dispositions and Abilities," Teaching Thinking Skills: Theory and Practice. Baron, Joan and Sternberg, Robert, eds. New York: W. H. Freeman and Company, 1987.

(10) Fredericksen, Norman. "Implications of Cognitive Theory for Instruction in Problem Solving," Review of Educational Research, Fall, 1984, Vol 54, No.3, pp 363-407.

(11) Keirsey, David and Bates, Marilyn. Please Understand Me. Del Mar, CA: Prometheus Nemesis Books, 1978.

(12) Lawrence, Gordon. People Types and Tiger Stripes. Gainesville, FL: Center for Application of Psychological Type, Inc., 1982.

(13) _____ "A Synthesis of Learning Style Research Involving the MBTI," Journal of Psychological Type, Vol 8, 1984.

(14) McCaulley, Mary H. The Myers-Briggs Type Indicator and The Teaching-Learning Process. Gainesville, FL: Center for Application of Psychological Type, Inc., 1976.

(15) Myers, Isabel. The Myers-Briggs Type Indicator Manual, 1962. Palo Alto, CA: Consulting Psychologists Press, Inc., 1962.

(16) _____ Type and Teamwork. Gainesville, FL: Center for Applications of Psychological Type, 1979.

(17) _____ Gifts Differing. Palo Alto CA: Consulting Psychologists, Press, Inc., 1980.

(18) Nickerson, Raymond S. "Why Teach Thinking?" Teaching Thinking Skills: Theory and Practice. Baron, Joan and Sternberg, Robert, eds. New York: W. H. Freeman and Company, 1987.

(19) Ruggiero, Vincent R. The Art of Thinking: A Guide to Critical and Creative Thought. New York: Harper & Row, Publishers, 1984.

(20) Sanford, Anthony J. Cognition and Cognitive Psychology. Basic Books, Inc: New York, 1985, p1.

(21) Sewell, Timothy J. (1986). The Measurement of Learning Styles: A Critique of Four Assessment Tools. Green Bay, WI: Wisconsin Assessment Center, University of Wisconsin Green Bay.

(22) Swartz, Robert J. "Teaching for Thinking: A Developmental Model for the Infusion of Thinking Skills into Mainstream Instruction," Teaching Thinking Skills: Theory and Practice. Baron, Joan and Sternberg, Robert, eds. New York: W. H. Freeman and Company, 1987.

(23) Yinger, Robert. "Can We Teach Them to Think?" New Directions for Teaching and Learning. Robert Young, ed. San Francisco: Josey-Bass, 1980, pp 11-30.

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